

Document No. R-04-200-300

ADDITIONAL ENVIRONMENTAL TEST REPORT

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Test Report

(IMO Resolution MEPC.174(58),
Guidelines for Approval of Ballast Water Management System (G8),
Part 3 – Specification for Environmental Testing for Approval of
Ballast Water Management Systems)

For

Trade name: Miura Co., Ltd.

Model: Ballast Water Management System (BWMS)

Type: ---

Report No.: FLI 12-14-045

Date of Issue: 27 June 2014


Furuno Labotech International Co., Ltd.

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Report Summary

FLI project number:	FLI 04-13-0559/-14-0297		
Test report number of initial issue:	FLI 12-14-045	Date of initial issue	27 June 2014
Test report number of revised/replaced issue:	---	Date of revised/replaced issue	---
Test report revision/replacement history:	---		
Test standard(s)/ Test specifications:	IMO Resolution MEPC.174(58), Guidelines for Approval of Ballast Water Management System (G8), Part 3 – Specification for Environmental Testing for Approval of Ballast Water Management Systems: 3.4/3.5/3.6/3.7 Vibration tests; 3.9/3.10 Temperature tests; (Equipment category: Equipment installed in an enclosed space that is environmentally controlled including an engine-room) 3.11 Humidity tests; 3.13 Fluctuation in power supply; 3.14 Inclination tests. IEC 60068-2-1: 2007, IEC 60068-2-2: 2007, IEC 60068-2-6: 2007, IEC 60068-2-30: 2005.		
Customer:	Miura Co., Ltd. 7 Horie-cho Matsuyama, Ehime, 799-2696 Japan		
Manufacturer:	Miura Co., Ltd. 7 Horie-cho Matsuyama, Ehime, 799-2696 Japan		
Trade name:	Miura Co., Ltd.		
Model:	Ballast Water Management System (BWMS)		
Type:	---		
Product function and intended use:	Ballast Water Management		
Number of test samples tested:	One		
Serial number:	See Clause 1.1 of this report.		
Power rating:	3 ϕ 440 VAC, and 24 VDC.		
Product status:	Production model		
Modifications made to samples during testing:	None.		
Date of receipt of samples:	1 November 2013		
Test period:	From 2 November 2013 to 22 January 2014		
Place of test:	Furuno Labotech International Co., Ltd. - LABOTECH EMC Center 1-16, Fukazu-cho, Nishinomiya-shi, Hyogo, 663-8203 Japan - Nishinomiya Lab. 9-52 Ashihara-cho, Nishinomiya-shi, Hyogo, 662-8580 Japan - Nishinomiya-Hama Lab. 2-20, Nishinomiya-Hama, Nishinomiya-shi, Hyogo, 662-0934 Japan		
Test results/ Compliance:	Passed. The test results of this report relate only to the samples tested.		
Tested by:	Akira Inoue, Ryoich Ito, Katsumi Imamura, Fumiya Ueki and Osamu Araki		
Written by:	Akiko Inoue		
Verified by:	Yoshihiro Ishii		
Approved by:	Date: 27 June 2014 Name: Yoshihiro Ishii Title: Senior Manager, Technical Department, Furuno Labotech International Co., Ltd. Signature: 		

Testing Laboratory Status

Furuno Labotech International Co., Ltd. (hereafter called "FLI") has been holding the following status after having been assessed according to the provisions of ISO/IEC 17025 and/or the relevant rules:

(1) JAB Accredited Testing Laboratory:

- accredited by Japan Accreditation Board (JAB),
- Laboratory accreditation number: RTL03220
- Date of initial accreditation: 14 January 2011
- Scope of accreditation: Electrical testing - EMC testing (*)

(2) Telefication Listed Testing Laboratory:

- listed by Telefication B. V., (The Netherlands)
- Laboratory assignment number: L116
- Date of initial listing: 26 July 1999 (*)
- for testing the following product categories/ test standards: EN 60945, IEC 61162-1/-2, and IEC 62288

(3) BSH Recognized Testing Laboratory:

- recognized by Bundesamt für Seeschifffahrt und Hydrographie (BSH), (Germany)
- Recognition certificate number: BSH/4613/06202/1864/11
- Date of initial recognition: 4 April 2003 (*)
- for testing the following product categories/ test standards:
- IEC/EN 60945, IEC 62388, IEC 61162-1/-2, and IEC 62288

(4) TÜV Appointed EMC Test Laboratory:

- appointed by TÜV Rheinland Japan Ltd.,
- Laboratory assignment number: UA 50046428
- Date of initial appointment: 21 December 1998 (*)
- for carrying out the tests of: EN 55011, CISPR 11, EN 55022, CISPR 22, EN 55024, CISPR 24, EN 55025, CISPR 25, EN/IEC 61000-3-2/-3, EN/IEC 61000-4-2/-3/-4/-5/-6/-8/-11, EN/IEC 61000-6-1/-2/-3/-4, EN/IEC 60945, EN/IEC 61326-1, EN/IEC 61326-2-6, EN/IEC 60601-1-2, JIS T 0601-1-2, JIS C 1806-1, ISO 11452-1/-2/-4.

(5) RMRS Recognized Testing Laboratory:

- recognized by Russian Maritime Register of Shipping (RMRS), (Russia)
- Laboratory recognition number: 11.02594.011
- Date of initial recognition: 27 January 2009 (*)
- for carrying out testing in the field of: Electrical measurements and tests, EMC tests, Mechanical measurements and tests, Equipment protection degree tests, and Climatic tests for Ship's radio and navigational equipment and IEC 60945: 2002

(6) RRR Recognized Test Laboratory:

- recognized by Russian River Register (RRR), (Russia)
- Recognition certificate number: 154262
- Date of initial recognition: 31 May 2013
- for carrying out of tests of ships radio and navigation equipment

(7) DNV Recognized Environmental Test Laboratory:

- recognized by Det Norske Veritas AS (DNV), (Norway)
- Recognition certificate number: 262.1-015854-J-12
- Date of initial recognition: 12 July 2013
- Scope of recognition: Testing according to the standards IEC 60945, IEC 61162-1/-2/-450, IEC 62288, IEC 62388 and IEC 62252 Annex E
- Application: Provisions of Environmental, interface and safety testing.

(8) CCS Recognized Test Agency :

- recognized by China Classification Society
- Recognition certificate number : DB13A00001
- Date of initial recognition : 29 January 2014
- Scope of recognition : Performance/Environmental/EMC/Special purpose/Safety precautions tests for Electrical & Electronic Product including Maritime Navigation and Radio-communication Equipment & Systems

Note: (*) – The current certificates may be found in the FLI web site (<http://www.furuno-labotech.co.jp>).

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1 Principal Information

1.1 Equipment under test (EUT)

Configurations of the EUT units:

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
1	Differential pressure transmitter	GC52-212-X511101XXXX1	XU1-10045	Nagano Keiki Co., Ltd.	
2	Ball valve	AE2BR001UUF	1310	Nippon Valve Controls, Inc.	
3	Motor (Back wash motor)	GM-SF 0.4kWX440VX60Hz 1/100	021910	Mitsubishi Electric Corp.	
4	Motor (High pressure pump)	CRN5-24J 7.5kWX440VX60Hz GFHEM	D1203312	Grundfos Pumps K.K.	
5	Motor (Back wash pump)	GEZ-806-2M7.5 7.5kWX440VX60Hz	859022363112 220009	Kawamoto Pump Mfg. Co., Ltd. (Hitachi Industrial Equipment Systems Co., Ltd.)	
6	Flow meter	EGM2100C 10K250A	S13313130	Tokyo Keiso Co., Ltd.	
7	Flow control valve	250A×10K 700G-3E+L/S+ POSITION	13037D01491	Tomoe Valve Co., Ltd.	
8	Butterfly valve	250A×10K 700G-3E+S.V.+L/ S	11037D01719	Tomoe Valve Co., Ltd.	

(*): Item number(s) is(are) corresponding to the unit(s) shown in Clause 5 "EUT Setup/Test Arrangement" and Clause 6 "Photographs of Test Setup/Arrangement" of this report.

Size and Mass of the EUT unit(s):

No.	Name	Type	Dimensions (W × H × D, or φ × H) (mm)	Mass (kg)	Power supply
1	Differential pressure transmitter	GC52-212-X511101XXXX1	65 × 130 × 113	0.6	24 VDC
2	Ball valve	AE2BR001UUF	165 × 302 × 145	9.7	24 VDC
3	Motor (Back wash motor)	GM-SF 0.4kWX440VX60Hz 1/100	190 × 317 × 199	12.1	3φ 440 VAC
4	Motor (High pressure pump)	CRN5-24J 7.5kWX440VX60Hz GFHEM	471 × 300 × 300	46	3φ 440 VAC
5	Motor (Back wash pump)	GEZ-806-2M7.5 7.5kWX440VX60Hz	427.5 × 257 × 358.5	45	3φ 440 VAC
6	Flow meter	EGM2100C 10K250A	412 × 502 × 331	55	24 VDC
7	Flow control valve	250A×10K 700G-3E+L/S+ POSITION	252 × 826 × 392	40	4 - 20 mA DC (*)
8	Butterfly valve	250A×10K 700G-3E+S.V.+L/S	234 × 698 × 420	40	24 VDC

(*): current input.

Configurations of the Associated unit(s) (AU) forming the system except EUT: None.

Auxiliary Equipment (AE) used for exercising and/or monitoring the operation and/or the performance of the EUT during testing:

No. (*)	C/N	Name	Type	Unit serial number	Mfr.	Note
9	---	DC signal source	7011	080817393	Hioki E.E.Corp.	
10	RT103	3-phase dry step-up transformer	STH-20	510010-4	Sugahara	

No. (*)	C/N	Name	Type	Unit serial number	Mfr.	Note
11	RT119	Low voltage 3-phase dry step-up transformer	CCD-50S	50312	Shintechno	
12	RT120	Slide regulator	S3-24100	110101	Matsunaga	
13	RT121	Inverter	FRN7.5E1S-4J	88A731A0197F	Fuji Electric	

(*): Item number(s) is(are) corresponding to the unit(s) shown in Clause 5 of this report.

Software(s) contained in the EUT, AU and AE: None.

1.2 EUT Performance Check

Following Performance Check should be made before/during/after the tests:

Item	EUT		Method/Criterion
(1) Operation check	1	Differential pressure transmitter	When the water with the head pressure of about 10 cm high is applied to the "Hi" detection port, the detected current should be about 4.16 mA. (only the operation is checked, current value is not judged.)
	2	Ball valve	When the valve control terminal is connected to the GND after 24 VDC power supplied to the EUT, the valve should be opened, and when the terminal is opened, the valve should be closed.
	3	Motor (Back wash motor)	The EUT's motor should be able to start and stop.
	4	Motor (High pressure pump)	The EUT's motor should be able to start and stop.
	5	Motor (Back wash pump)	The EUT's motor should be able to start and stop.
	6	Flow meter	[Flow detection]: Measured value in the second decimal place of the meter indication (0.01 m ³ /h) should be varied, and also corresponding current output should be varied. [Flow transmission]: When the current of 4 mA and 20 mA is outputted to the Terminator (220 Ω resistor) by using the simulated current output test function embedded in the EUT, the corresponding voltage across the resistor should be able to be measured. (only the operation is checked, voltage value is not judged.)
	7	Flow control valve	When the DC current of 4 mA is supplied to the EUT, the valve should be closed, and when 20 mA is supplied, the valve should be opened.
	8	Butterfly valve	When 24 VDC power is supplied to the EUT, the valve should be opened, and when the power is shut off, the valve should be closed.
(2) Visual check			Following external appearance/signs should not occur: (a) deformation; (b) breakage; (c) missing/dropping parts; (d) looseness of screws; (e) unusual sound.

1.3 Observation and comments

- (1) Test items to be performed were specified by the customer.
- (2) For the "Fluctuation in power supply" test, the test were performed in the presence of Mr. Yoshinobu Hiraki of Miura Co., Ltd.

1.4 Measurement uncertainties

IMO Resolution MEPC.174(58)	Item	Measurement uncertainty (*)
3.4/3.5/3.6/3.7	Vibration tests	Acceleration: $\pm 2.2 \text{ m/s}^2$
3.9/3.10	Temperature tests	Temperature: $\pm 1.5^\circ\text{C}$
3.11	Humidity tests	Temperature: $\pm 1.5^\circ\text{C}$, Humidity: $\pm 5\%$
3.13	Fluctuation in power supply	Transient voltage: $\pm 1.0\%$
3.14	Inclination test	---

(*): confidence level = 95%, coverage factor $k = 2$

2 Test Results Summary

IMO Resolution MEPC.174(58)	Test Item	Result	Test Engineer
3.4/3.5/3.6/3.7	Vibration tests	Passed.	F. Ueki, R. Ito, and K. Imamura
3.9/3.10	Temperature tests	Passed.	A. Inoue
3.11	Humidity tests	Passed.	A. Inoue
3.13	Fluctuation in power supply	Passed.	O. Araki
3.14	Inclination test	Passed.	R. Ito

3 Test Results

3.1 Vibration tests

Test specifications applied:	IMO Resolution MEPC.174(58), Guidelines for Approval of Ballast Water Management System (G8), Part 3 – Specification for Environmental Testing for Approval of Ballast Water Management Systems, 3.4/3.5/3.6/3.7 Vibration tests.						
EUT evaluation:	See 1.2 of this report.						
EUT attitude/ mounting:	Floor-standing						
Test fixture:	For EUT 1 and 3, A604-278-0000 used (submitted by the customer) For EUT 4, A604-280-0000 used (submitted by the customer) For EUT 5, No.44 used. (FLI's property) For EUT 2, 6, 7, and 8: not used.						
EUT operation:	Powered-off						
Test condition:	Test item	Frequency (Hz)	vibration amplitude/ acceleration	Sweep time (min)	Vibration direction	Number of test	Total test time (h)
	(1) Resonance search	2 to 13.2	1 mm	10	each of the three orthogonal planes	3 for each direction	1.5
		13.2 to 80	0.7 g	10			1.5
	(2) Vibration endurance	Same as (1) at each major resonance frequency		---		---	6 (*)
		30 if no resonance occurred	0.7 g	---		---	6
	(3) Resonance search after vibration endurance	2 to 13.2	Same as (1)			1 for each direction	0.5
		13.2 to 80					0.5

(*) Total test time depends on the number of the resonance points detected.

Results

(1) Resonance search:

EUT no.	Unit	Vibration direction	Resonance search test				Result
			Frequency (Hz)	Acceleration (m/s ²)	Magnitude ratio Q	measured result	
1	GC52-212-X511101 XXXX1	X	63.7	69.9	10.0	4.20 mA	Passed.
		Y	27.8	70.4	10.1	4.22 mA	Passed.
		Z	27.4	18.8	2.7	4.16 mA	Passed.
2	AE2BR001UUF	X	80.0	15.3	2.2	---	Passed.
		Y	(*)	NA	NA	---	Passed.
		Z	(*)	NA	NA	---	Passed.
3	GM-SF 0.4kWX440VX60Hz 1/100	X	(*)	NA	NA	---	Passed.
		Y	(*)	NA	NA	---	Passed.
		Z	(*)	NA	NA	---	Passed.
4	CRN5-24J 7.5kWX440VX60Hz GFHEM	X	73.1	409.5	58.5	---	Passed.
			77.1	201.8	28.8	---	Passed.
		Y	74.2	58.4	8.3	---	Passed.
			67.2	50.3	7.2	---	Passed.
5	GEZ-806-2M7.5 7.5kWX440VX60Hz	X	(*)	NA	NA	---	Passed.
		Y	(*)	NA	NA	---	Passed.
		Z	(*)	NA	NA	---	Passed.
6	EGM2100C	X	59.4	184.6	26.4	---	Passed.

EUT no.	Unit	Vibration direction	Resonance search test				Result
			Frequency (Hz)	Acceleration (m/s ²)	Magnitude ratio Q	measured result	
	10K250A		80.0	51.6	7.37	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
		Y	67.7	76.4	10.9	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
		Z	(*)	NA	NA	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
7	250A×10K 700G-3E+L/S +POSITION	X	36.7	74.6	10.6	---	Passed.
		Y	21.0	155.9	22.3	---	Passed.
			37.2	157.9	22.6	---	Passed.
		Z	(*)	NA	NA	---	Passed.
8	250A×10K 700G-3E+S.V.+L/S	X	55.0	160.5	22.9	---	Passed.
		Y	31.0	156.8	22.4	---	Passed.
		Z	78.9	15.8	2.3	---	Passed.

Note: (*) – no resonance detected, NA – Not applicable.

(2) Vibration endurance:

EUT no.	Unit	Vibration direction	Endurance test			Result
			performed at freq. (Hz)	Duration (h)	measured result	
1	GC52-212-X511101 XXXX1	X	63.7	2	4.17 mA	Passed.
		Y	27.8	2	4.20 mA	Passed.
		Z	27.4	2	4.20 mA	Passed.
2	AE2BR001UUF	X	80.0	2	---	Passed.
		Y	30.0	2	---	Passed.
		Z	30.0	2	---	Passed.
3	GM-SF 0.4kWX440VX60Hz 1/100	X	30.0	2	---	Passed.
		Y	30.0	2	---	Passed.
		Z	30.0	2	---	Passed.
4	CRN5-24J 7.5kWX440VX60Hz GFHEM	X	73.1	2	---	Passed.
			77.1	2	---	Passed.
		Y	74.2	2	---	Passed.
			67.2	2	---	Passed.
5	GEZ-806-2M7.5 7.5kWX440VX60Hz	X	30.0	2	---	Passed.
		Y	30.0	2	---	Passed.
		Z	30.0	2	---	Passed.
6	EGM2100C 10K250A	X	59.4	2	---	Passed.
			80.0	2	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
		Y	67.7	2	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
		Z	30.0	2	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
7	250A×10K 700G-3E+L/S +POSITION	X	36.7	2	---	Passed.
		Y	21.0	2	---	Passed.
			37.2	2	---	Passed.
		Z	30.0	2	---	Passed.

EUT no.	Unit	Vibration direction	Endurance test			Result
			performed at freq. (Hz)	Duration (h)	measured result	
8	250A×10K 700G-3E+S.V.+L/S	X	55.0	2	---	Passed.
		Y	31.0	2	---	Passed.
		Z	78.9	2	---	Passed.

(3) Resonance search after vibration endurance:

EUT no.	Unit	Vibration direction	Resonance search test				Result
			Frequency (Hz)	Acceleration (m/s ²)	Magnitude ratio Q	measured result	
1	GC52-212-X511101 XXXX1	X	63.2	67.7	9.7	4.21 mA	Passed.
		Y	27.2	69.7	10.0	4.24 mA	Passed.
		Z	27.4	16.9	2.4	4.19 mA	Passed.
2	AE2BR001UUF	X	80.0	17.0	2.4	---	Passed.
		Y	(*)	NA	NA	---	Passed.
		Z	(*)	NA	NA	---	Passed.
3	GM-SF 0.4kW×440V×60Hz 1/100	X	(*)	NA	NA	---	Passed.
		Y	(*)	NA	NA	---	Passed.
		Z	(*)	NA	NA	---	Passed.
4	CRN5-24J 7.5kW×440V×60Hz GFHEM	X	72.5	531.6	75.9	---	Passed.
		Y	74.2	60.0	8.6	---	Passed.
			66.6	56.4	8.1	---	Passed.
		Z	(*)	NA	NA	---	Passed.
5	GEZ-806-2M7.5 7.5kW×440V×60Hz	X	(*)	NA	NA	---	Passed.
		Y	(*)	NA	NA	---	Passed.
		Z	(*)	NA	NA	---	Passed.
6	EGM2100C 10K250A	X	57.2	204.5	29.2	---	Passed.
			80.0	54.3	7.8	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
		Y	68.2	76.5	10.9	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
		Z	(*)	NA	NA	0.889 V for 4 mA Output, and 4.45 V for 20 mA Output	Passed.
7	250A×10K 700G-3E+L/S +POSITION	X	41.8	105.8	15.1	---	Passed.
		Y	18.7	70.5	10.1	---	Passed.
			34.6	81.6	11.7	---	Passed.
		Z	(*)	NA	NA	---	Passed.
8	250A×10K 700G-3E+S.V.+L/S	X	44.8	128.9	18.4	---	Passed.
		Y	30.1	147.7	21.1	---	Passed.
		Z	80.0	17.7	2.5	---	Passed.

Note: (*) – no resonance detected, NA – Not applicable.

There found be no significant change in the vibration pattern between the both resonance search tests.

3.2 Temperature tests

Test specifications applied:	IMO Resolution MEPC.174(58), Guidelines for Approval of Ballast Water Management System (G8), Part 3 – Specification for Environmental Testing for Approval of Ballast Water Management Systems, 3.9/3.10 Temperature tests. (Equipment category: Equipment installed in an enclosed space that is environmentally controlled including an engine-room)
EUT evaluation:	See 1.2 of this report.
Test condition:	0°C, and 55°C (for equipment installed in an enclosed space that is environmentally controlled including an engine-room)
Duration period:	2 h
Operation check:	At the end of each of the tests referred to in the above, the equipment should be switched on and the operation should be checked under the test conditions.

Result:

EUT no.	Unit	Result	Note
1	GC52-212-X511101XXXX1	Passed.	Current measured: 4.15 mA during 0°C, 4.14 mA during 55°C
2	AE2BR001UUF	Passed.	
3	GM-SF 0.4kWX440VX60Hz 1/100	Passed.	
4	CRN5-24J 7.5kWX440VX60Hz GFHEM	Passed.	
5	GEZ-806-2M7.5 7.5kWX440VX60Hz	Passed.	
6	EGM2100C 10K250A	Passed.	Voltage measured: 0.887 V for 4 mA Output, and 4.44 V for 20 mA Output during 0°C, 0.887 V for 4 mA Output, and 4.44 V for 20 mA Output during 55°C.
7	250A×10K 700G-3E+L/S+POSITION	Passed.	
8	250A×10K 700G-3E+S.V.+L/S	Passed.	

3.3 Humidity tests

Test specifications applied:	IMO Resolution MEPC.174(58), Guidelines for Approval of Ballast Water Management System (G8), Part 3 – Specification for Environmental Testing for Approval of Ballast Water Management Systems, 3.11 Humidity tests.
EUT evaluation:	See 1.2 of this report.
Test condition:	55°C, 90%RH
Test duration:	2 h
Operation check:	Equipment should be left switched off for a period of two hours at a temperature of 55°C in an atmosphere with a relative humidity of 90%. After the test, the equipment should be switched on and the operation should be checked for the period of one hour. (*)

(*): The timing of Operation check was specified by the customer.

Result:

EUT no.	Unit	Result	Note
1	GC52-212-X5111101XXXX1	Passed.	Current measured: 4.16 mA
2	AE2BR001UUF	Passed.	
3	GM-SF 0.4kW440VX60Hz 1/100	Passed.	
4	CRN5-24J 7.5kW440VX60Hz GFHEM	Passed.	
5	GEZ-806-2M7.5 7.5kW440VX60Hz	Passed.	
6	EGM2100C 10K250A	Passed.	Voltage measured: 0.887 V for 4 mA Output, and 4.44 V for 20 mA Output.
7	250A×10K 700G-3E+L/S+POSITION	Passed.	
8	250A×10K 700G-3E+S.V.+L/S	Passed.	

3.4 Fluctuation in power supply

Test specifications applied:	IMO Resolution MEPC.174(58), Guidelines for Approval of Ballast Water Management System (G8), Part 3 – Specification for Environmental Testing for Approval of Ballast Water Management Systems, 3.13 Fluctuation in power supply.
EUT evaluation:	See 1.2 of this report.
Test condition:	(1) a voltage variation of +/- 10% together with a simultaneous frequency variation of +/- 5%, (upper side: 484 VAC (440 VAC + 10%), 63 Hz (60 Hz + 5%), lower side: 396 VAC (440 VAC - 10%), 57 Hz (60 Hz - 5%). and (2) a transient voltage of +/- 20% together with a simultaneous frequency transient of +/- 10%, (upper side: 528 VAC (440 VAC + 20%), 66 Hz (60 Hz + 10%), lower side: 352 VAC (440 VAC - 20%), 54 Hz (60 Hz - 10%).

Result:

EUT no.	Unit	Result	Note
1	GC52-212-X511101XXXX1	Not applicable.	
2	AE2BR001UUF	Not applicable.	
3	GM-SF 0.4kW X440V X60Hz 1/100	Passed.	
4	CRN5-24J 7.5kW X440V X60Hz GFHEM	Passed.	
5	GEZ-806-2M7.5 7.5kW X440V X60Hz	Passed.	
6	EGM2100C 10K250A	Not applicable.	
7	250A×10K 700G-3E+L/S+POSITION	Not applicable.	
8	250A×10K 700G-3E+S.V.+L/S	Not applicable.	

3.5 Inclination test

Test specifications applied:	IMO Resolution MEPC.174(58), Guidelines for Approval of Ballast Water Management System (G8), Part 3 – Specification for Environmental Testing for Approval of Ballast Water Management Systems, 3.14 Inclination tests.
EUT evaluation:	See 1.2 of this report.
Test condition: (*)	STATIC, 22.5°, Front-up, Rear-up, Right-up, and Left-up

(*): Test condition was specified by the customer.

Result:

EUT no.	Unit	Result	Note
1	GC52-212-X511101XXXX1	Passed.	Current measured: 4.16 mA
2	AE2BR001UUF	Passed.	
3	GM-SF 0.4kW440VX60Hz 1/100	Passed.	
4	CRN5-24J 7.5kW440VX60Hz GFHEM	Passed.	
5	GEZ-806-2M7.5 7.5kW440VX60Hz	Passed.	
6	EGM2100C 10K250A	Passed.	Voltage measured: 0.887 V for 4 mA Output, and 4.44 V for 20 mA Output.
7	250A×10K 700G-3E+L/S+POSITION	Passed.	
8	250A×10K 700G-3E+S.V.+L/S	Passed.	

3.6 Environmental conditions during Testing

IMO Resolution MEPC.174(58)	Test Item	Date of test	Temperature, humidity (Before-test to After-test)	Power supply voltage (Before-test to After-test)
3.4/3.5/3.6/3.7	Vibration tests	2 November 2013	22°C to 22°C, 66%RH to 66%RH	24.0 VDC to 24.0 VDC, 450.0 VAC, 60.0 Hz to 442.0 VAC, 60.0 Hz
		3 November 2013	24°C to 24°C, 68%RH to 68%RH	24.0 VDC to 24.0 VDC, 442.0 VAC, 60.0 Hz to 450.0 VAC, 60.0 Hz
		4 November 2013	22°C to 22°C, 70%RH to 70%RH	24.0 VDC to 24.0 VDC, 456.0 VAC, 60.0 Hz to 450.0 VAC, 60.0 Hz
		18 December 2013	17°C to 18°C, 70%RH to 53%RH	448.1 VAC, 60.0 Hz to 441.8 VAC, 60.0 Hz
		19 December 2013	18°C to 20°C, 62%RH to 64%RH	453.1 VAC, 60.0 Hz to 440.9 VAC, 60.0 Hz
		21 December 2013	17°C to 18°C, 70%RH to 53%RH	24.0 VDC to 24.0 VDC
		23 December 2013	18°C to 18°C, 53%RH to 53%RH	24.0 VDC to 24.0 VDC
		24 December 2013	17°C to 17°C, 61%RH to 70%RH	24.0 VDC to 24.0 VDC
		25 December 2013	18°C to 21°C, 36%RH to 40%RH	24.0 VDC to 24.0 VDC
		26 December 2013	17°C to 17°C, 70%RH to 72%RH	24.0 VDC to 24.0 VDC, 456.0 VAC, 60.0 Hz to 450.0 VAC, 60.0 Hz
3.9/3.10	Temperature tests	8 December 2013	19°C to 19°C, 54%RH to 54%RH	24.0 VDC to 24.0 VDC, 438.2 VAC, 60.0 Hz to 446.0 VAC, 60.0 Hz

IMO Resolution MEPC.174(58)	Test Item	Date of test	Temperature, humidity (Before-test to After-test)	Power supply voltage (Before-test to After-test)
3.11	Humidity tests	9 December 2013	20°C to 20°C, 48%RH to 48%RH	24.0 VDC to 24.0 VDC, 446.7 VAC, 60.0 Hz to 451.6 VAC, 60.0 Hz
3.13	Fluctuation in power supply	9 January 2014	19°C to 20°C, 46%RH to 52%RH	439.6VAC, 60.0 Hz to 439.6VAC, 60.0 Hz
		22 January 2014	21°C to 22°C, 45%RH to 50%RH	439.0VAC, 60.0 Hz to 440.0VAC, 60.0 Hz
3.14	Inclination test	3 December 2013	22°C to 22°C, 70%RH to 70%RH	24.0 VDC to 24.0 VDC, 456.0 VAC, 60.0 Hz to 450.0 VAC, 60.0 Hz
		26 December 2013	17°C to 17°C, 70%RH to 72%RH	24.0 VDC to 24.0 VDC, 456.0 VAC, 60.0 Hz to 450.0 VAC, 60.0 Hz

4 List of Measuring Equipment/Test Facilities

Measuring/Test instruments have been appropriately calibrated/maintained according to the FLI programs/ procedures and ISO/IEC 17025. Measuring/Test instruments used for the tests are listed below.

4.1 Vibration tests

C/N	Instrument	Type	S/N	Manufacturer
HT562	Vibration test system (3.5-ton type)	G-0235LS	SG-4420	SHINKEN
HT577	Pickup sensor (*1)	V11-101S	0522	SHINKEN
HT578	Pickup sensor (*1)	V11-101S	0521	SHINKEN
HT439	Pickup sensor (*1)	VP-15	2325T	IMV
HT462	Digital Multimeter (*2)	111	78120001	Fluke
HT431	DC Power Supply (*3)	PAN55-20	AK003303	Kikusui
HT780	AC/DC Power Supply	ES18000W	9128767-1+ 9128767-2	NF

(*1): checked with calibrated measuring equipment (Acceleration pickup sensor calibrator VE-20) before use.

(*2): used for 24 VDC power supply voltage setting for EUT 1, 2, 6, and 8, for current measurements for EUT 1, for voltage measurements across the Resistor (220 Ω) connected to the EUT 6, and for 3 ϕ 440 VAC 60 Hz power supply measurements for EUT 3, 4, and 5.

(*3): used for 24 VDC power supply for EUT 1, 2, 6, and 8.

4.2 Temperature and Humidity tests

C/N	Instrument	Type	S/N	Manufacturer
HT510	Climatic chamber (Hama-L)	TBE-3HW4PE2F	3013002540	ESPEC
HT866	Digital Multimeter (*4)	115	19170029	Fluke
HT725	DAQSTATION FX100	FX106-4-1	S5JA01447	YOKOGAWA
HT462	Digital Multimeter (*2)	111	78120001	Fluke
HT431	DC power supply (*3)	PAN55-20	AK003303	Kikusui
HT780	AC/DC power supply	ES18000W	9128767-1+ 9128767-2	NF

(*2): used for 24 VDC power supply voltage setting for EUT 1, 2, 6, and 8, for current measurements for EUT 1, for voltage measurements across the Resistor (220 Ω) connected to the EUT 6, and for 3 ϕ 440 VAC 60 Hz power supply measurements for EUT 3, 4, and 5.

(*3): used for 24 VDC power supply for EUT 1, 2, 6, and 8.

(*4): used for 3 ϕ 440 VAC 60 Hz power supply measurements for EUT 3, 4 and 5.

4.3 Fluctuation in power supply

C/N	Instrument	Type	S/N	Manufacturer
HT780	AC/DC power supply	ES18000W	9128767-1+ 9128767-2	NF
HT462	Digital Multimeter (*2)	111	78120001	Fluke

(*2): used for 3 ϕ 440 VAC 60 Hz power supply measurements for EUT 3, 4, and 5.

4.4 Inclination test

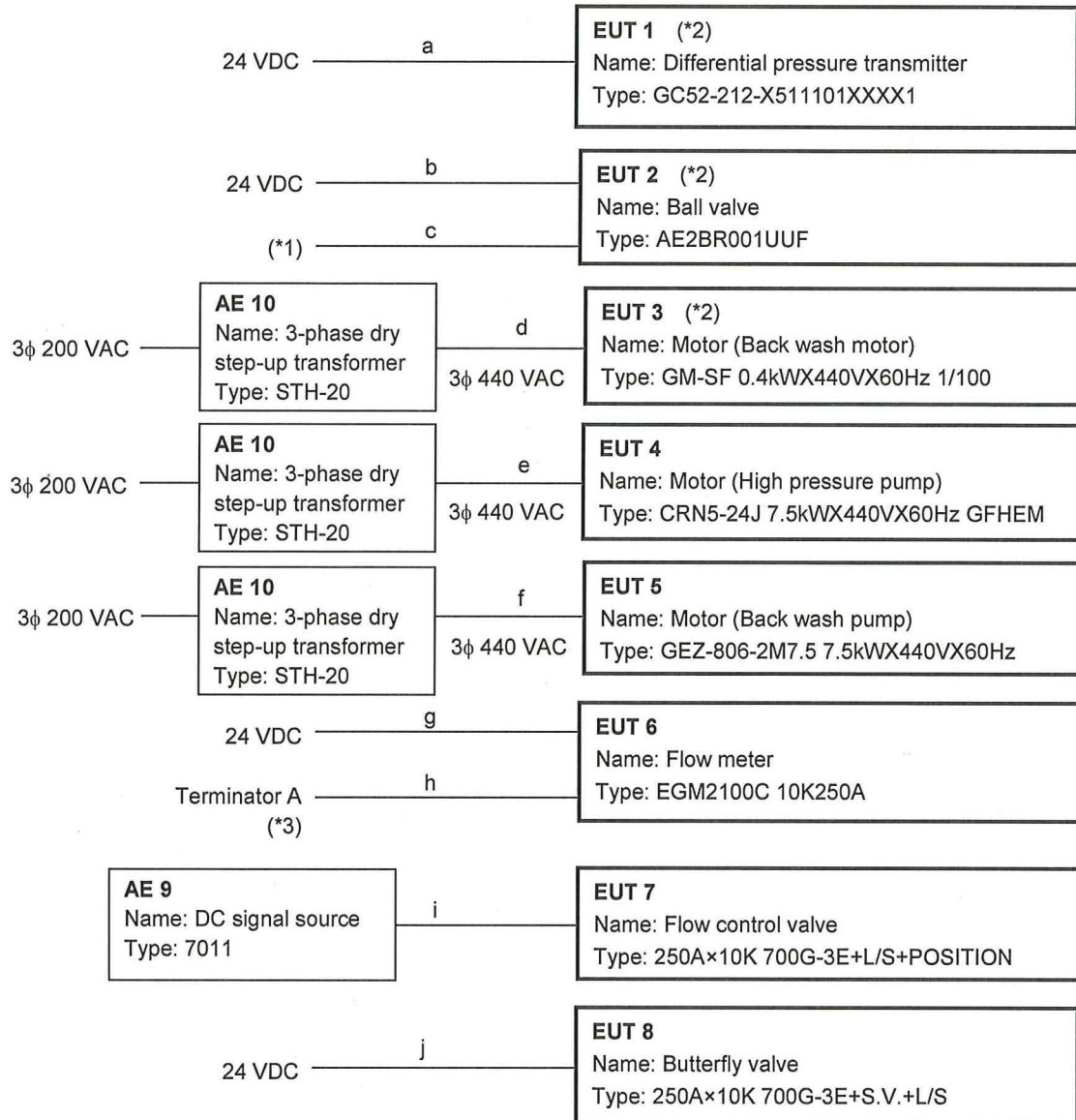
C/N	Instrument	Type	S/N	Manufacturer
HT907	Support table	No.62	---	FLI
HT462	Digital Multimeter (*2)	111	78120001	Fluke
HT431	DC power supply (*3)	PAN55-20	AK003303	Kikusui
HT780	AC/DC power supply	ES18000W	9128767-1+ 9128767-2	NF

(*2): used for 24 VDC power supply voltage setting for EUT 1, 2, 6, and 8, for current measurements for EUT 1, for voltage measurements across the Resistor (220 Ω) connected to the EUT 6, and for 3 ϕ 440 VAC 60 Hz power supply measurements for EUT 3, 4, and 5.

(*3): used for 24 VDC power supply for EUT 1, 2, 6, and 8.

5 EUT Test Setup/Arrangement

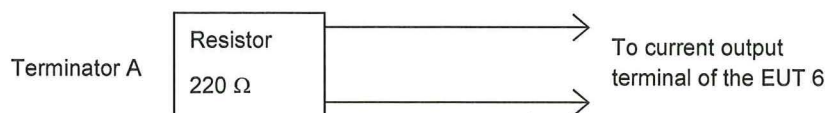
5.1 Vibration, Temperature, Humidity, and Inclination tests



(*1): When the valve control terminal was connected to GND, the valve of EUT 2 was opened, and also when the terminal was opened, the valve was closed.

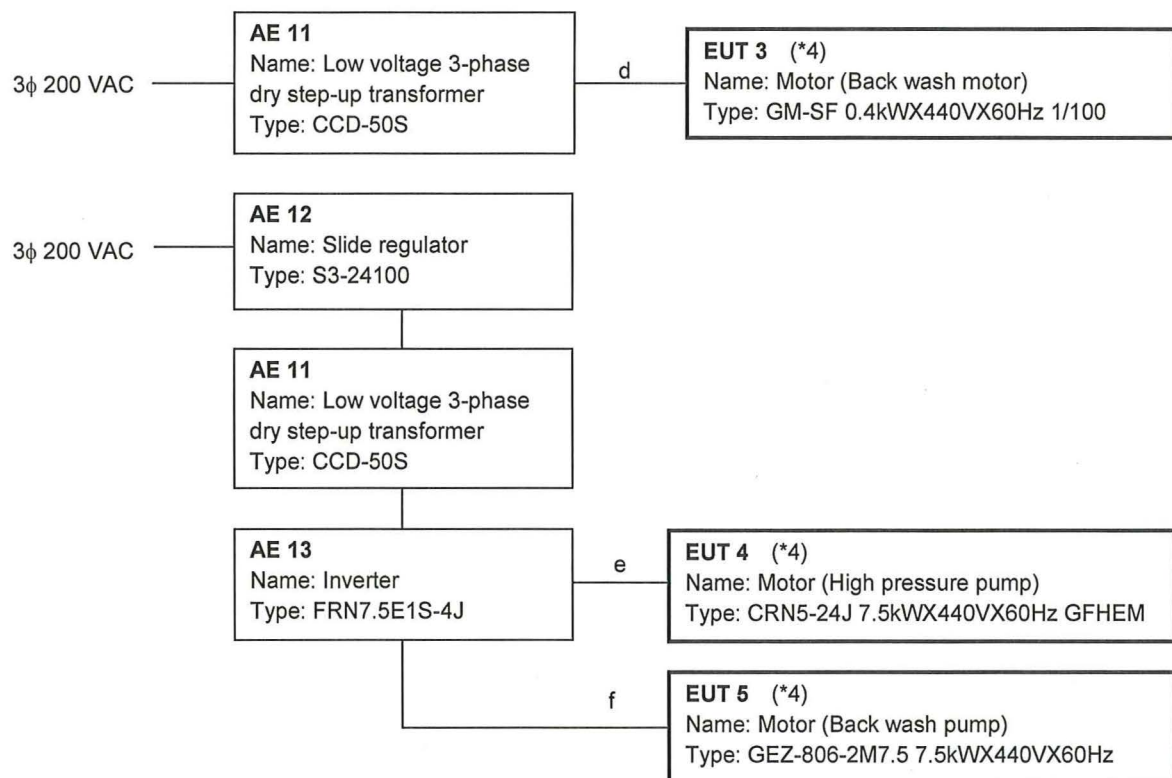
(*2): For Vibration tests, the EUT 1, 2, and 3 were installed on the Test Table, and then tested simultaneously, and for Inclination test, the EUT 1 and 3 were installed on the Test Table (Support Table), and then tested simultaneously at the customer's request.

(*3): The currents were measured across the Terminator A (220 Ω Resistor) connected to the Cable h.



List of Cables used:

No.	Name	Type	Length (m)	Number of cables used	Note
a	Power cable	---	3	1	FLI's property
b	Power cable	---	5	1	FLI's property
c	Ball valve opening/closing cable	---	5	1	FLI's property
d	Power cable	---	3	1	FLI's property
e	Power cable	---	3	1	FLI's property
f	Power cable	---	3	1	FLI's property
g	Power cable	---	5	1	FLI's property
h	Flow meter current check cable	---	5	1	Terminated with 220 Ω. FLI's property
i	Power cable	---	5	1	FLI's property
j	Power cable	---	5	1	FLI's property

5.2 Fluctuation in power supply


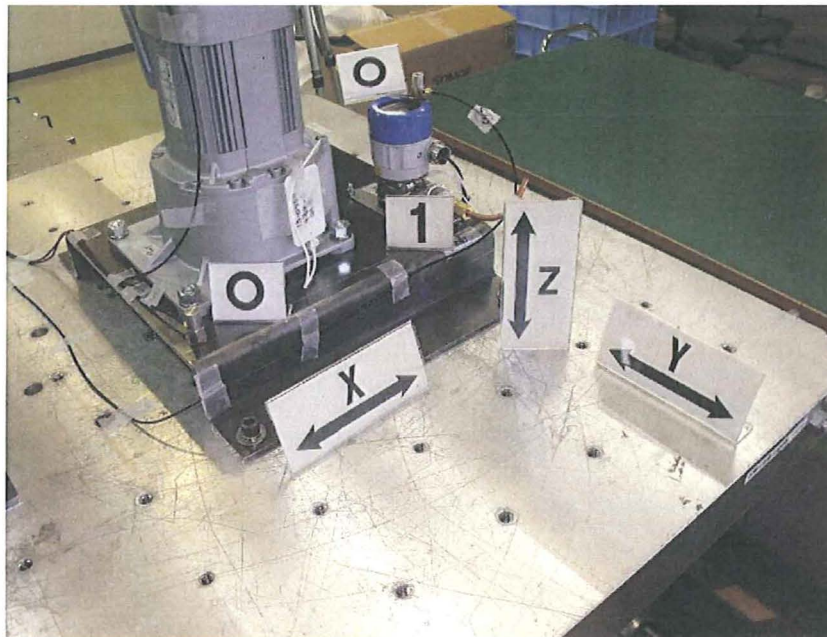
(*4): 440 VAC up-converted from 200 VAC was supplied to the EUT.

List of cables used:

No.	Name	Type	Length (m)	Number of cables used	Note
d	Power cable	---	3	1	FLI's property
e	Power cable	---	3	1	FLI's property
f	Power cable	---	3	1	FLI's property

6 Photographs of the EUT Test Setup/Arrangement

6.1 Vibration tests



○ : pick-up sensor, \longleftrightarrow : vibration direction

Photo 6.1.1 EUT 1 Differential pressure transmitter

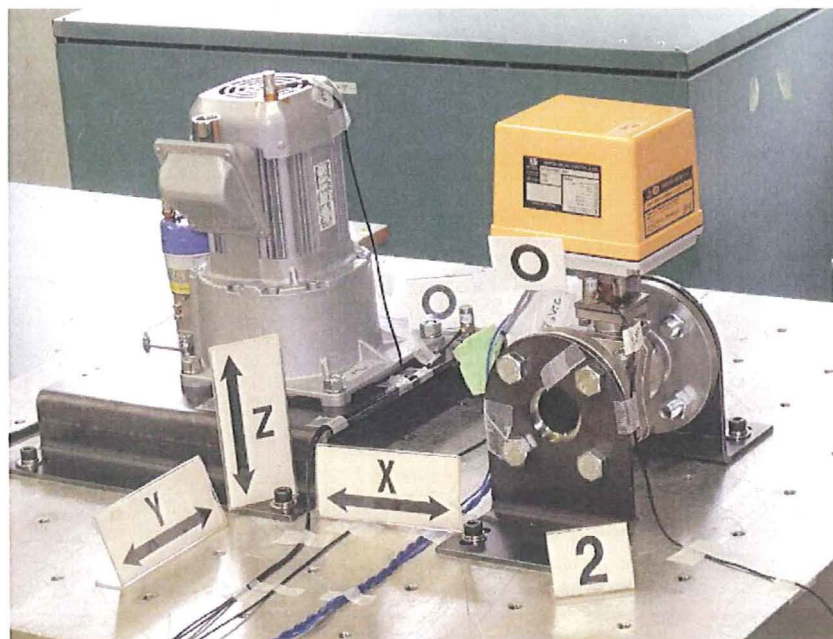
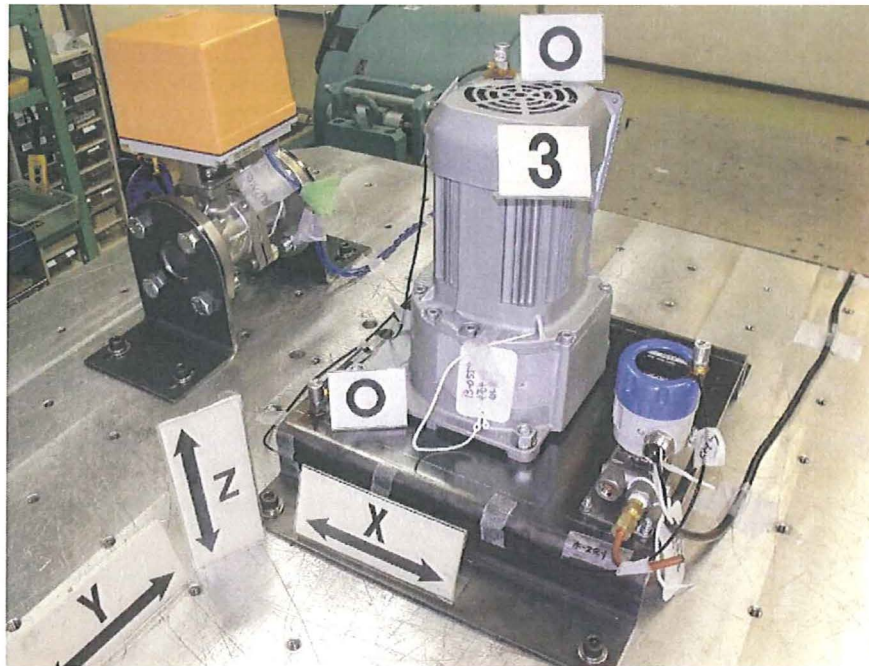


Photo 6.1.2 EUT 2 Ball valve



○ : pick-up sensor, \longleftrightarrow : vibration direction

Photo 6.1.3 EUT 3 Motor (Back wash motor)

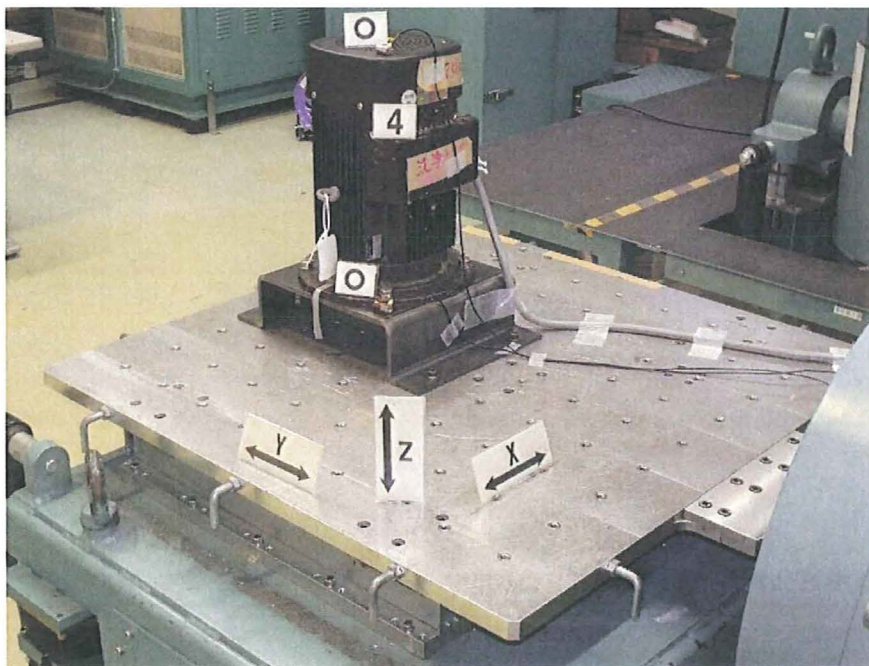


Photo 6.1.4 EUT 4 Motor (High pressure pump)